

GOODWIN, PROCTER & HOAR

(A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS)

COUNSELLORS AT LAW

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JEFFREY C. BATES

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April 10, 1989

BY HAND

Barbara Newman
Remedial Project Manager
U.S. Environmental Protection
Agency, Region I
Waste Management Division
(HRS-CAN 3)
JFK Federal Building
Boston, MA 02203-2211



SDMS DocID

548888

Re: Wells G and H Indoor Air Monitoring

Dear Barbara:

As promised, I am enclosing copies of resumes for the three experts we have engaged to help design and implement an indoor air monitoring program in response to the concerns raised by the Massachusetts Department of Public Health in the draft health assessment it prepared on the Wells G and H site for ATSDR. The three experts are Dr. Warner North, Dr. Rudolph Jaeger and Dr. John Spengler. Drs. North and Spengler currently serve on EPA's Science Advisory Board (Dr. North is Vice Chairman of its Environmental Health Committee), and Dr. Jaeger has been a frequent consultant to EPA and the Department of Justice; all have experience with indoor air monitoring studies. Dr. North's specialty is risk assessment (he was a co-author of Risk Assessment in the Federal Government); Dr. Spengler is an expert on indoor air monitoring techniques (he is a professor of environmental health at the Harvard School of Public Health); and Dr. Jaeger is a board-certified toxicologist with subspecialties in inhalation toxicology and chlorinated solvents (he teaches toxicology at NYU and Harvard).

As I advised you this morning, and as Mark Stoler and I advised Gretchen Muench last Friday, we would be happy to make these experts and an experienced air sampling team from ENSR available to assist EPA in implementing an indoor air

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monitoring program at the Wells G and H site, if and as you deem appropriate, at our expense. As we discussed, we will be taking additional air measurements at the UniFirst facility under the direction of these individuals and will be happy to provide you with the results, as well as coordinating our efforts with EPA if and as you so desire. As I mentioned, previous air monitoring by UniFirst at its facility has not detected any health hazard.

Sincerely,



Jeffrey C. Bates

JCB/dg

Enclosure

cc: Gretchen Muench
Mark Stoler, Esq.

XP-1290/u

04/10/1989 13:10 HARVARD SCHOOL/PUB HEALTH 617 277 2382

P.02

CURRICULUM VITAE

NAME: JOHN DANIEL SPENGLER
Professor of Environmental Health
Director, Physical Science & Engineering Program

ADDRESS: Department of Environmental Science & Physiology
Harvard University
School of Public Health
665 Huntington Avenue, Bldg.1-1305
Boston, MA 02115
(617) 732-1255

EDUCATION

1973	Environmental Health Sciences	M.S. Harvard University School of Public Health
1971	Atmospheric Sciences	Ph.D. State University of New York Albany
1966	Physics	B.S. University of Notre Dame

ACADEMIC APPOINTMENTS

07/01/73 - Present	Faculty of Environmental Health Sciences Environmental Science and Physiology Harvard University, School of Public Health
07/01/72 - 06/30/73	US Environmental Protection Agency, Special Fellow Environmental Health Sciences Harvard University, School of Public Health
07/01/71 - 06/30/72	Research Associate, Meteorology Environmental Health Sciences Harvard University, School of Public Health

ADVISORY BOARDS

1988 - Present	US EPA Science Advisory Board Research Strategies Advisory Committee
1985 - Present	US EPA Science Advisory Board Ad Hoc Committee on Exposure Assessment

1983 - 1988	World Health Organization and WHO Europe Advisor to India and Chinese Exposure Studies Member of Ad Hoc Committee on Indoor Air Pollution Member of Ad Hoc Committee on Air Pollution Guidelines
1984 - 1986	American Lung Association Air Conservation Committee
1982 - 1986	Carnegie-Mellon University Indoor Air Pollution-Energy Conservation Study
1984 - 1985	American Society of Heating, Refrigerating and Air Conditioning Engineers Ad Hoc Committee on Environmental Health
1982 - 1984	Columbia University, School of Public Health New York City Asthma Study
1980	USEPA Workshop on Particulate Epidemiology
1979 - 1982	University of Texas, School of Public Health Air Pollution Health Study
1977 - 1978	Commonwealth of Massachusetts' Governor's Commission on Co-Generation
1976 - 1977	US Department of Commerce Technical Advisory Board on Sulfur Oxide Controls
1976 - 1977	US Environmental Protection Agency Transportation Control Strategies Advisory
1975 - 1977	New England Council for Economic Development

PROFESSIONAL SOCIETIES

AIR POLLUTION CONTROL ASSOCIATION

1973 - Present	Professional Member
1976 - 1979	Director, New England Section
1976	Chairman, Specialty Conference on Toxic Substances in the Air Environment
1977 - Present	Member, Technical Committees on Indoor Air Quality
1979 - Present	Member, Biomedical Effects of Air Pollution (Chairman, 1984-1985)

AMERICAN METEOROLOGICAL SOCIETY

1971 - Present	Professional Member
1979 - Present	Certified Consulting Meteorologist (AMS)
1979 - 1985	Committee on Meteorological Aspects of Air Pollution
1979 - 1983	Admissions Board, Chairman 1982
1976 - 1979	Board of Meteorological Education
1977 - 1978	President, Greater Boston Chapter
1973 - 1974	Assistant Editor of the Journal of Applied Meteorology

BOSTON MUSEUM OF SCIENCE

1976 - Present	Member of the Corporation
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NATIONAL INSTITUTE OF HEALTH

1979	Task Force on Pulmonary Epidemiology
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NATIONAL RESEARCH COUNCIL/NATIONAL ACADEMY OF SCIENCES

1983 - 1986	Commission on Physical Sciences, Mathematics and Resources
1985 - 1986	Vice-Chairman, Committee on Air Craft Cabin Air Quality & Safety
1985 - 1986	Member, Committee on Passive Smoke Effect
1984 - 1985	Member, Committee on Air Pollution Epidemiology
1979 - 1981	Chairman, Committee on Indoor Pollutants
1978 - 1979	Member, Committee on Controlling Airborne Particulates

NEW ENGLAND CONSORTIUM ON ENVIRONMENTAL PROTECTION

1973 - 1977	Director of the Regional Environmental Program
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FACULTY RESPONSIBILITY

Over the last ten years, taught courses in Air Pollution, Meteorology and Environmental Management. Conducted seminars and tutorials in ambient and indoor monitoring, dispersion modeling and policy analysis of air pollution control. Faculty advisor for the following doctoral students.

CORTESE, ANTHONY.	Ability of fixed monitoring stations to represent personal carbon monoxide exposures. 1976
DOCKERY, DOUGLAS.	Personal exposure to respirable particulates and sulfates: Measurement and prediction. 1979

COLOME, STEVEN.	Trace element characterization of ambient and residential aerosols. 1981
THURSTON, GEORGE.	Elemental characterization of ambient aerosols for source apportionment. 1983
SEXTON, KENNETH.	Personal exposures to wood-burning particulate matter: study of Waterbury, Vermont. 1983
CHOW, JUDITH.	Development of a composite model to assess air pollution source/receptor relationships. 1985
KINNEY, PATRICK.	An assessment of acute lung function change in children exposed to community air pollution. 1986
MCCARTHY, JOHN.	Physical and biological markers to assess exposure to environmental tobacco smoke. 1988
HARLOS, DAVID.	Acute exposures to nitrogen dioxide during cooking or commuting. 1988
SANTANAM, SURESH.	Indoor-outdoor source contribution to respirable particulate exposures. 1989
BRAUER, MICHAEL.	Determination of personal exposures to acidic aerosols and gases. In progress.
CHANG-CHUAN, CHAN.	Commuter exposure study: driver's exposure to volatile organic compounds, nitrogen dioxides, ozone, and carbon monoxide. In progress.
SU, JENNY.	Examination of indoor microbiological contamination, housing characteristics and health. In progress.

MAJOR RESEARCH INTERESTS

Since 1975, Co-Principal Investigator for aerometric measurements for an air pollution health study on the respiratory effects of sulfur oxides and particulates in six U.S. cities. This long term study is being sponsored by the National Institute of Health Sciences, Environmental Protection Agency and the Electric Power Research Institute. This has involved the design, installation and operation of continuous air monitoring equipment as well as data analysis. The object of these measurements is to define population exposures to air pollution.

Co-Principal Investigator of National Institute of Environmental Health Sciences cross-sectional air pollution epidemiologic study. Focus of study is the respiratory effects of acidic aerosols and gases on children. Study conducted in 24 U.S. cities in cooperation with Health and Welfare Canada.

Co-Principal Investigator of a prospective epidemiologic study investigating respiratory illnesses in infants and exposures to NO₂. Study being conducted in Albuquerque, New Mexico in cooperation with Dr. Jonathan Samet, University of New Mexico Medical School. The study is sponsored by the Health Effects Institute.

Principal Investigator for a study entitled "Assessment of Public Total Exposure to Selected Emissions Species Contributed in Part by Indoor Sources," sponsored by the Gas Research Institute, Chicago, IL. 1983 - 1990.

Principal Investigator on several continuing contracts to assist Health and Welfare Canada on an acute health effects study conducted in Ontario, Canada. Children attending a summer camp were examined daily for respiratory symptoms and pulmonary function changes that may be related to fluctuation in atmospheric concentrations of long range transported air pollutants.

Principal Investigator of technical exchange and research contract with the electric utilities of Spain, UNESA/AMYS, 1984 - Present

Principal Investigator for a Department of Energy funded project entitled, "Analysis of Health Effects Resulting from Population Exposure to Ambient Particulate Matter." The study is an attempt to quantify the health risk associated with human particle exposures and to identify the relative harm from various components of the particulate matter. This was a three year study through the Energy and Environmental Policy Center (1982-1985).

Principal Investigator for USEPA cooperative agreement grant to study personal exposures to respirable particles and gases. Investigations have been conducted in Kingston/Harriman, TN, Portage, WI, and Waterbury, VT. The Vermont study examined the contribution of woodburning to indoor and personal exposures. Have continued work on the development and application of personal monitoring instruments for particles, NO₂, nicotine, and acid aerosols under EPA cooperative agreements.

Co-organizer of the International Symposium on Indoor Air Pollution, Health and Energy Conservation, October 13-16, 1981, held at the University of Massachusetts at Amherst.

PUBLICATIONS

- Spengler and Gokhale. "Investigating Freely Suspended Water Drop Interactions With High-speed Photography. J. of Society for Motion Picture and Television Engineers. 7:559-560. 1971.
- Gokhale and Spengler. "Contact Nucleation of Freely Suspended Supercooled Water Drops. J. Appl. Meteor. 1:157-160. 1972.
- Spengler and Gokhale. "Freezing of Freely Suspended Supercooled Water Drops in a Large Vertical Wind Tunnel. J. of Appl. Meteor. 7:1101-1107. 1972.
- Gokhale and Spengler. "Artificial Growth of "Icicle" Lobe Structure of a Hailstone in a Wind Tunnel." J. Appl. Meteor. 2:418-420. 1973
- Spengler and Gokhale. "Drop Impactions. J. Appl. Meteor. 2:316-321. 1973.
- Spengler and Gokhale. "Wake Effect Interaction of Freely Suspended, Large Water Drops. J. Geophys. Res. 3:497-503. 1973.
- Spengler, Cortese, and Dockery. "Nitrogen Oxide Emissions and Their Distribution." Air Quality and Stationary Source Emission Control. A Report by the Commission of Natural Resources, National Academy of Sciences. Serial #94-4, Chapters 14 & 15. March, 1974.
- Kleiner and Spengler. "Carbon Monoxide Exposures to Boston Bicyclists.: J. Air Poll. Control Assoc. 1975.
- Mahoney and Spengler. "Meteorological Content of Environmental Impact Assessments. Lectures on Air Pollution and Environmental Impact Analysis." Lectures on Air Pollution and Environment. American Meteorological Society Workshop. Boston, MA. 1975.
- Ferris, Speizer, Bishop, and Spengler. "Comparison of Prevalence of Respiratory Symptoms in Various Communities with Different Levels of Pollution." American Review of Respiratory Disease. 15:213. 1977.
- Ferris, Speizer, Spengler, Dockery, Bishop, Wolfson, and Humble. "Effects of Sulfur Oxides and Respirable Particulates on Human Health: Methodology and Demography of Populations in Study." American Review of Respiratory Disease. 120(4):767-779. 1979.
- Ferris, Speizer, Spengler, Dockery, Bishop, Wolfson, and Colome.. "Relationship Between Outdoor and Indoor Air Pollution and the Implications on Health." Indoor Climate - Effects on Human Comfort, Performance and Health in Residential, Commercial and Light-Industry Buildings. 25-37. 1979.
- Spengler, J. D.. "Comments on: Atmospheric Dispersion Modeling: A Critical Review Discussion." JAPCA. 29(9):929-930. 1979.
- Spengler, Colome, Dawson, Evans, Dockery, and Thibodeau. "Prediction and Review of Health Effects of Direct Coal Combustion." The Direct Use of Coal: Prospects and Problems of Production and Combustion. Office of Technology Assessment. 202-220. 1979.

- Spengler, Ferris, Dockery, and Speizer. "Sulfur Dioxide and Nitrogen Dioxide Levels Inside and Outside Homes and the Implications on Health Effects Research." Environmental Science and Technology. 13(10):1276-1280. 1979.
- Turner, Spengler, Dockery, and Colome. "Design and Performance of a Reliable Personal Monitoring System for Respirable Particulates." IAPCA. 29(7):747-748. 1979.
- Ferris, Speizer, Bishop, Spengler, and Ware. "The Six City Study: A Progress Report." Atmospheric Sulfur Deposition: Environmental Impact and Health Effects. Ann Arbor, MI. 1980.
- Speizer, Ferris, Bishop, and Spengler. "Health Effects of Indoor NO₂ Exposure - Preliminary Results." Nitrogen Oxides and Their Effects on Health. 343-359. 1980.
- Speizer, Ferris, Bishop, and Spengler. "Respiratory Disease Rates and Pulmonary Function in Children Associated with NO₂ Exposure." American Review of Respiratory Disease. 121:3-10. 1980.
- Dockery and Spengler. "Indoor-Outdoor Relationships of Respirable Sulfates and Particulates." Atmospheric Environment. 15:335-343. 1981.
- Dockery and Spengler. "Personal Exposure to Respirable Particulates and Sulfates." IAPCA. 31(2):153-159. 1981.
- Dockery, Spengler, Reed, and Ware. "Relationships Among Personal, Indoor, and Outdoor NO₂ Measurements." Environment International. 5:101-107. 1981.
- Ju, and Spengler. "Room-to-Room Variations in Concentration of Respirable Particles in Residences." Environmental Science and Technology. 15(5):592-596. 1981.
- Samet, Speizer, Bishop, Spengler, and Ferris. "The Relationship Between Air Pollution and Emergency Room Visits in an Industrial Community." IAPCA. 3:236-240. 1981.
- Spengler, Dockery, Turner, Wolfson, and Ferris. "Long-term Measurements of Respirable Sulfates and Particles Inside and Outside Homes." Atmospheric Environment. 15:23-30. 1981.
- Spengler, Turner, Fairchild, Slaughter, and Dzubay. Operation Manual for Automatic Dichotomous Samplers. Application to Beckman Dichotomous Samplers. EPA 600/8-81-007. 1981.
- Turner, Spengler, and Frank. "Development of a Portable Zero Air System." IAPCA. 31(8):882-884. 1981.
- Wilson, R., Colome, Spengler, and Wilson, D. G. Health Effects of Fossil Fuel Burning: Assessment and Mitigation. Cambridge, MA. Ballinger Press. 1981.
- Colome, Spengler, and McCarthy, S.. "Comparisons of Elements and Inorganic Compounds Inside and Outside of Residences." Environment International. 8:197-212. 1982.

- Dockery, Ware, Ferris, Speizer, Cook, Herman, and Spengler. "Change in Pulmonary Function in Children Associated with Air Pollution Episodes." IAPCA. 32(9):937-942. 1982.
- Quackenboss, Kanarek, Spengler, and Letz. "Personal Monitoring for Nitrogen Dioxide - Methodological Considerations for a Community Study." Environment International. 8:249-257. 1982.
- Spengler, J. D.. "Discussion-Critical Review." IAPCA. 32(9):907-909. 1982.
- Spengler, Hollowell, Moschandreas, and Fanger. "Guest Editors." Environment International. 1982.
- Spengler, J.D.. "Indoor Air Pollution and Public Health Concerns." Proceedings of American Institute of Medical Climatology. 1982.
- Tosteson, Spengler, and Weker. "Aluminum, Iron, and Lead Content of Respirable Particle Samples for a Personal Monitoring Study." Environment International. 8:265-268. 1982.
- Ryan, Spengler, and Letz. "The Effects of Kerosene Heaters on Indoor Pollutant Concentrations: A Monitoring and Modeling Study." Atmospheric Environment. 17(7):1339-1345. 1983.
- Sexton, Letz, and Spengler. "Estimating Human Exposures to Nitrogen Dioxide: An Indoor/Outdoor Modeling Approach." Environmental Research. 32:151-66. 1983.
- Spengler and Sexton. "Indoor Air Pollution: A Public Health Perspective." Science. 221:9-17. 1983.
- Spengler and Thurston. "Mass and Elemental Composition of Fine and Coarse Particles In Six US Cities." IAPCA. 33(12):1162-1171. 1983.
- Spengler, Duffy, Letz, Tibbets, and Ferris. "Nitrogen Dioxide Inside and Outside 137 Homes and Implications for Ambient Air Quality Standards and Health Effects Research." Environmental Science and Technology. 17:164-168. 1983.
- Kim, Spengler, and Yanagisawa. "Indoor Nitrogen Dioxide Pollution in Korea." Proceedings of the Third International Conference on Indoor Air Quality and Climate. 409-412. 1984.
- Letz, Ryan, and Spengler. "Estimating Distributions of Personal Exposure to Respirable Particles." Environmental Monitoring and Assessment. 4:351-359. 1984.
- Spengler and Soczek. "Evidence for Improved Ambient Air Quality and the Need for Personal Exposure Research." Environmental Science and Technology. 18:268A-280A. 1984.
- Turner, Marple, and Spengler. "Indoor Aerosol Impactor." Aerosols: Research, Risk Assessment and Control Strategies. 527-529. 1984.

- Ware, Spiro, Dockery, Speizer, Spengler, and Ferris. "Respiratory Illness in Children Exposed to Ambient Air Pollution, Cigarette Smoke, and Gas Stoves in Six US Cities." Amer. J. of Resp. Dis. 129:366-374. 1984.
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- Chow and Spengler. "Overview of Harvard Air Pollution Respiratory Health Study Program Part I: Project Design and Ambient Monitoring." Journal of Industrial Pollution Control. 1985.
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- Ozkaynak and Spengler. "Analysis of Health Effects Resulting from Population Exposures to Acid Precipitation Precursors." Environmental Health Perspectives. 63:45-55. 1985.
- Sexton, Liu, Hayward, and Spengler. "Characterization and Source Apportionment of Wintertime Aerosol in a Wood-Burning Community." Atmospheric Environment. 19(8):1225-1236. 1985.
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- Thurston and Spengler. "A Multivariate Assessment of Meteorological Influences on Inhalable Particle Source Impacts." Journal of Climate and Applied Meteorology. 24(11):1245-1256. 1985.
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- Ferris, Speizer, Ware, Spengler, and Dockery. "The Harvard Six-Cities Study." Aerosols: Research, Risk Assessment and Control Strategies. Chapter 54, 2453-2462. 1986

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- Quackenboss, Spengler, Kanarek, Letz, and Duffy. "Personal Exposure to Nitrogen Dioxide: Relationship to Indoor/Outdoor Air Quality and Activity Patterns." Environmental Science and Technology. 20(8):775-783. 1986.
- Sexton, Liu, Treitman, Spengler, and Turner. "Characterization of Indoor Air Quality in Woodburning Residences." Environment International. 12:265-278. 1986.
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- Ware, Ferris, Dockery, Spengler, Stram, and Speizer. "Effects of Ambient Sulfur Oxides and Suspended Particles on Respiratory Health of Preadolescent Children." American Review Respiratory Disease. 133:834-842. 1986.
- Dockery, Spengler, Speizer, Ferris, Ware, and Brunnekreef. "Associations of Health Status with Indicators of Indoor Air Pollution from an Epidemiologic Study in Six US Cities." Proceedings of The Fourth International Conference on Indoor Air Quality and Climate. 2:203-207. 1987.
- Harlos, Marbury, Samet, and Spengler. "Relating Indoor NO₂ Levels to Infant Personal Exposures." Atmospheric Environment. 21(7):369-376. 1987.
- Koutrakis, Wolfson, and Spengler. "An Improved Method for Measuring Aerosol Strong Acidity: Results from a Nine-Month Study in St. Louis, MO; and in Kingston, TN." Atmospheric Environment. 24(1):1-6. 1987.
- Koutrakis and Spengler. "Source Apportionment of Ambient Particles in Steubenville, OH using Specific Rotation Factor Analysis." Atmospheric Environment. 21(7):1511-1519. 1987.
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- Matsuki, Yanagisawa, Spengler, Ksuga. "Urinary Cotinine Measurements for Passive Smokers using Gas Chromatography and Flame Thermionic Detector with Glass Capillary Column." Proceedings of The Fourth International Conference on Indoor Air Quality and Climate. 2:85-90. 1987.
- McCarthy, Spengler, Chang, Coultas, and Samet. "A Personal Monitoring Study to Assess Exposure to Environmental Tobacco Smoke." Proceedings of The Fourth International Conference on Indoor Air Quality and Climate. 2:569-575. 1987.
- Ryan, Spengler, Treitman, Soczek, Yanagisawa. "Nitrogen Dioxide Exposure Assessment in Greater Boston: Evaluation of Personal Monitoring." Proceedings of the Fourth International Conference on Indoor Air Quality and Climate. 1:493-497. 1987.
- Samet, Marbury, and Spengler. "Health Effects and Sources of Indoor Air Pollution. Part I." American Review of Respiratory Disease. 136:1486-1508. 1987.
- Samet, Marbury, and Spengler. "Respiratory Effects of Indoor Air Pollution." The Journal of Allergy and Clinical Immunology. 79(5):685-700. 1987.
- Spengler, Ware, Speizer, Ferris, Dockery, Lebrecht, and Brunnekreef. "Harvard's Indoor Air Quality Respiratory Health Study." Proceedings of The Fourth International Conference on Indoor Air Quality and Climate. 2:218-224. 1987.
- Yanagisawa, Fasano, Spengler, Ryan, and Billick. "Removal of Nitrogen Dioxide by Interior Materials." Proceedings of the Fourth International Conference on Indoor Air Quality and Climate. 1:376-379. 1987.
- Koutrakis, Spengler, Chang, and Ozkaynak. "Characterizing Sources of Indoor and Outdoor Aerosols Using PIXE." Nuclear Instruments and Methods in Physics Research. 22:331-226. 1988.
- Samet, Marbury, and Spengler. "Health Effects and Sources of Indoor Air Pollution. Part II." American Review of Respiratory Disease. 137:221-242. 1988.
- Spengler, J. D.. "International Conference on Indoor Air Quality." The Indoor Pollution Law Report. 1988.
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- Koutrakis, Wolfson, Slater, Brauer, Spengler, and Stevens. "Evaluation of an Annular Denuder/Filter Pack System to Collect Acidic Aerosols and Gases." Environmental Science and Technology. 22:1463-1468. 1988.
- Parkhurst, Mallory, Humphreys, Harper, and Spengler. "Influence of Indoor Combustion Sources on Indoor Air Quality." Environmental Progress. 7(4):257-261. 1988.
- Raizenne, Spengler. "Dosimetric Model of Acute Health Effects of Ozone and Acid Aerosols in Children." Atmospheric Ozone Research and its Policy Implications, T. Schneider et al., Eds. The Netherlands: Elsevier Science Publishers, 1989, 319-329.
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- Dockery, Speizer, Stram, Ware, Spengler, and Ferris. "Effects of Inhalable Particles on Respiratory Health of Children." Am Rev. Respir. Dis. 139:587-594. 1989
- Spengler, Keeler, Koutrakis, Ryan, Raizenne, and Franklin. "Exposures to Acidic Aerosols" Environmental Health Perspectives. 79:43-51. 1989.
- Koutrakis, Wolfson, Spengler, Stern, and Franklin. "Acidity and Growth of Atmospheric Aerosol Sulfates." Journal of Geophysical Research. IN PRESS.
- Dalsey, Spengler, Kaarakka. "A Comparison of the Organic Chemical Composition of Indoor Aerosols during Woodburning and Non-Woodburning Periods." Environment International. IN PRESS.
- Koutrakis, Wolfson, Brauer, and Spengler. "Design of a Glass Impactor for an Annular Denuder/Filter Pack System." Journal of Aerosol Science and Technology. IN PRESS.
- Koutrakis, Fasano, Slater, Spengler, McCarthy, and Leaderer. "Design of a Personal Denuder Sampler to Measure Atmospheric Gases and Particles." Atmospheric Environment. IN PRESS.
- Brauer, Koutrakis, Wolfson, and Spengler. "Evaluation of an Annular Denuder System under Simulated Atmospheric Conditions." Atmospheric Environment. IN PRESS.

DR. D. WARNER NORTH, Principal

SPECIALIZED PROFESSIONAL COMPETENCE

Decision analysis; risk assessment and risk management; research and development planning; public policy analysis; analysis of environmental impacts; modeling of complex engineering, economic, and ecological systems.

MAJOR CONSULTING PROJECTS AT DECISION FOCUS (1977-present)

- *Electric Power Research Institute (EPRI).* Project leader or supervisor, development and applications of decision frameworks for acid deposition, coal combustion by-products, and ambient air quality standards.
- *Utility Air Regulatory Group (UARG).* Development and presentation of testimony to the EPA Clean Air Scientific Advisory Committee on the health impacts of short-term exposure to sulfur dioxide.
- *Office of Policy Analysis, U.S. Environmental Protection Agency (EPA).* Consultant on risk assessment methodology for major EPA cross-media studies of Santa Clara Valley and Denver.
- *Office of Toxic Substances, EPA.* Project leader, development of methodology to set priorities for testing and selecting regulatory strategy for toxic chemicals.
- *U.S. Department of Energy.* Consultant to the Deputy Assistant Secretary for Oil and Gas Programs on program strategy for enhanced oil recovery programs.
- *American Bar Association, Special Committee on Energy Law.* Consultant to committee for DOE study on state decision making for electric power facilities.
- *Los Alamos Scientific Laboratory.* Principal investigator, decision analysis application to federal R&D strategy on magnetic fusion.
- *Environmental Assessment Department, EPRI.* Project leader, development of a research planning format for EPRI environmental research.
- *Solar Energy Research Institute.* Principal investigator, development of integrating methodology for photovoltaics venture analysis to evaluate DOE commercialization strategy.
- *Major chemical company.* Consultant on regulatory and research strategies for a proprietary pesticide product.
- *Major oil company.* Analysis of environmental and health impacts of a process to make synthetic liquid fuels from coal.
- *Office of Fossil Energy, ERDA.* Project leader for Market Oriented Program Planning Study (MOPPS), a major analytical support effort to assist a large task force in assessing implications of the potential new twentieth century energy technologies and in recommending appropriate budgetary priorities to ERDA top management.

OTHER PROFESSIONAL EXPERIENCE

- Special consultant to the Administrator of the Federal Energy Administration for review of the petroleum price regulation program (1977).

Science Advisory Board, U.S. Environmental Protection Agency

- Member, Subcommittee on Risk Assessment (1979 - present) and Environmental Health Committee (1982 - present, Vice Chairman since 1985).
- Chairman, Panel on Research in Support of Risk Assessment; Member, Carcinogenicity Risk Assessment Guidelines Review Group; Member, Extrapolation Models Review Panel; Member, Integrated Environmental Management Subcommittee; Co-chairman, Acute Toxics Subcommittee; Vice Chairman, Stratospheric Ozone Subcommittee; Vice Chairman, Hazard Ranking System Review Subcommittee (1985-1988).
- Member, Subcommittee on Lead, and Subcommittee on Ozone, Clean Air Scientific Advisory Committee (1985 - present).

National Research Council/National Academy of Sciences

- Member, Committee on the Institutional Means for Assessment of Risks to Public Health, (1981-1983).
- Member, Committee on Health and Ecological Effects of Synfuels Industries, (1982-1985).
- Member and Assistant Chairman, Stockpile Assessment Panel, Committee on Demilitarizing Chemical Munitions and Agents, (1983-1984).
- Consultant, review of DOE methodology for high level waste site selection, Board on Radioactive Waste Management (1985-1986).
- Invited Participant, Workshop on Research Needs in Risk Analysis (June 1986).
- Member, Committee on Risk Perception and Communication (1987-1988).

State of California

- Member, Science Advisory Panel, Safe Drinking Water and Toxic Enforcement Act (Proposition 65). Co-Chair, Risk Assessment Subpanel (1987-1988).

MAJOR CONSULTING PROJECTS AT STANFORD RESEARCH INSTITUTE (1967-77)

- *Division of Fossil Energy, ERDA.* Project leader, establishment of priorities of R&D programs on fossil energy technologies, including coal gasification, synthetic liquids from coal and shale, and advanced fossil fueled electric generation technologies.
- *Jet Propulsion Laboratory and NASA.* Project leader or supervisor of four projects, assessment of probability of biological contamination from interplanetary space missions.

- *Forest Service, U.S. Department of Agriculture.* Project leader or supervisor of five projects, analysis of policy on wildland fire protection, including evaluation of large computer models for fire simulation and resource management.
- *National Science Foundation.* Principal investigator, development of a framework to compare economic, environmental, health, and safety impacts of coal and nuclear electric generation.
- *Office of Management and Budget and Interagency Task Force on Synthetic Fuels Commercialization.* Project supervisor and principal investigator, evaluation of the environmental impacts, cost-benefit analysis of strategic program alternatives, and projections of synthetic fuel supply and demand.
- *National Caries Program, National Institutes of Health.* Project supervisor, analysis of R&D project selection.
- *Department of Defense.* Principal investigator, conceptual design and illustrative application of system for allocating information-gathering resources.
- *National Oceanic and Atmospheric Administration.* Project leader, analysis of U.S. policy on hurricane modification.
- *Private Client.* Consultant to top level corporate task force on major gas turbine product strategy decision, including carrying out market analysis of utility decision to buy product offering.
- *Comision Federal de Electricidad, Government of Mexico.* Analysis of nuclear power and electric capacity expansion decisions; development of electric utility capacity expansion model.

CONSULTING ASSOCIATE PROFESSOR, DEPARTMENT OF ENGINEERING-ECONOMIC SYSTEMS, STANFORD UNIVERSITY (1976-1988)

- Supervisor of graduate student research. Application areas include forest and fishery resource management, communications satellite planning, decision analysis of medical treatment.
- Graduate-level course on environmental risk analysis.
- Guest lecturer for graduate-level courses in decision analysis and summer executive seminar programs.

MANAGEMENT AND TECHNICAL EDUCATION EXPERIENCE

- Over fifty seminars in decision analysis, risk assessment, capital expenditure analysis, and related subjects for analysts and executives in the United States, Europe, and Latin America.
- Invited presentations, lectures, and testimony for a variety of professional societies, conferences, academic audiences, public utility commissions, and legislative bodies.

RESEARCH EXPERIENCE

- Development of complex probabilistic models for forecasting and control.
- Theoretical unification of entropy characterization and sufficient statistics characterization of families of probability distributions.
- Research on the assessment of social values in complex public policy contexts, including time preference, risk attitude, and valuation of externalities.

MANAGEMENT EXPERIENCE

- President, Decision Focus Incorporated (1979-1981, 1983-1984).
- Assistant Director, Decision Analysis (1975-1977) at Stanford Research Institute.
- Supervisor or leader of over thirty-five major DFI and SRI research projects.

ACADEMIC BACKGROUND

- Ph.D., Operations Research, Stanford University (1970); decision theory, decision analysis, optimization theory and mathematical programming, probabilistic systems modeling and analysis, economics.
- M.S., Physics (1963) and Mathematics (1966), Stanford University.
- B.S., Physics, Yale University (1962).

PROFESSIONAL ASSOCIATIONS AND HONORS

Associate Editor, *Management Science*. Operations Research Society of America, the Institute of Management Science, Society for Risk Analysis (Currently Councilor and President of Northern California Chapter). Sigma Xi, Phi Beta Kappa. National Science Foundation fellowships in physics, mathematics.

SELECTED PUBLICATIONS

"The Decision to Seed Hurricanes," *Science*, (1972) "The Invariance Approach to the Probabilistic Encoding of Information," Ph.D. dissertation. "The Abnormality of Normal Models for Processes That Evolve in Time," *Proceedings of the Fifth International Conference on Operational Research*, Venice (1969). "A Tutorial Introduction of Decision Theory," *IEEE Transactions on Systems Science and Cybernetics*, (1968) Publications on decision analysis applications in *Fire Journal*, *Space Research and Life Science*, *Computers and Operations Research*, and *Management Science*. Contributions to five National Academy of Sciences Reports. Approximately twenty-five DFI, SRI, and government reports on specific research projects.

CURRICULUM VITAE

RUDOLPH JOHN JAEGER

Principal Scientist
and President

Environmental Medicine, Inc.

PERSONAL DATA

Residence:	48 James Street Westwood, NJ 07675
Business Address:	263 Center Avenue Westwood, NJ 07675
Telephone Locators	(201) 666-7929 (24 hr business number) (201) 358-0273 (24 hr residence number) (914) 351-4539 (university office)
Present Academic Position:	Research Professor
Appointed:	1983
Academic Affiliation and Address:	New York University Medical Center Institute of Environmental Medicine 550 First Avenue, New York, NY 10016
Message Telephone:	(914) 351-2300
Date and Place of Birth:	January 17, 1944 Weehawken, New Jersey

Education

High School:	Stevens Academy, Hoboken, New Jersey Diploma, 1962
Undergraduate Education:	Rensselaer Polytechnic Institute, Troy, New York, Biology, B.S. 1966 Fairleigh Dickinson University Teaneck, New Jersey Non-degree, Clinical Psychology, 1963, 1964
Graduate Training:	Johns Hopkins University, School of Hygiene and Public Health, Baltimore, Maryland Ph.D., Biochemical Toxicology, 1971
Post-Doctoral Training	None Required
Post-doctoral Courses:	Harvard University, School of Public Health, Boston, Massachusetts Auditor, Respiratory Physiology, 1978 Tufts University Asbestos Information Center Asbestos Inspector/ Asbestos Management Plan January 11-15, 1988

PROFESSIONAL AFFILIATIONS

Society of Toxicology

Society of Toxicology of Canada

American Academy of Clinical Toxicology

American Industrial Hygiene Association

American Conference of
Governmental Industrial Hygienists

American Chemical Society

American Association of Pathologists

American Association for the
Advancement of Science

Sigma Xi (Harvard - Radcliffe Chapter)

Middle-Atlantic Section,
Society of Toxicology

Toxicology Forum
(Individual Member)

Inhalation Toxicology Specialty Section,
Society of Toxicology

Society for Risk Analysis

American Society for Testing and Materials

HONORS

Research Career Development Award,
National Institute of Environmental
Health Sciences, NIH. DHHS
1978-1983

Leslie Silverman Award, New England
Section, American Industrial Hygiene
Association, 1980

EDITORIAL SERVICE

Editorial Boards: Journal of Toxicology and Environmental Health
Journal of the American College of Toxicology
Boston Bulletin on Chemicals and Disease
NYU Medical Center Health Letter

LICENSURE AND CERTIFICATION

Certification: Diplomate, American Board of Toxicology, 1980
Recertified by Re-examination, 1985

Board Eligible: Professional Standards Review,
American Academy of Toxicological Sciences

American Board of Industrial Hygiene
Toxicologic Aspects of Industrial Hygiene

Accreditation: Asbestos Inspector/ Asbestos Management Planner,
Asbestos in Schools, AHERA

TEACHING EXPERIENCE

From 1972 through 1979, Rudolph J. Jaeger was a member of the staff and faculty of the Harvard University School of Public Health, holding the rank of Research Associate in Toxicology, Assistant Professor of Toxicology and Associate Professor of Toxicology. Since 1979, Professor Jaeger has been at New York University where he is currently Research Professor of Environmental Medicine at New York University Medical School. He continues to teach at Harvard University where he is Visiting Lecturer on Industrial Toxicology and Environmental Medicine in the Department of Environmental Health Sciences and Physiology in the School of Public Health. He has been invited to lecture at Clark University in Worcester, MA, the University of Rhode Island in Kingston, RI, the John B. Pierce Foundation of Yale University in New Haven, CT, Hunter College in Manhattan, Ramapo College in New Jersey, the New York State Division of Laboratories in Albany, NY and the AT&T Bell Laboratories in Murray Hill NJ and Lisle, IL. He has spoken before numerous professional societies (regional sections of the AIHA, ACS, Radiological Physics Society, etc.) and the US Department of Justice, Assistant Attorneys-General, training meeting on Superfund and toxic tort litigation. A more specific listing of Dr. Jaeger's experience is given in the following sections.

ACADEMIC, INDUSTRIAL, GOVERNMENTAL APPOINTMENTS
AND CONSULTATIVE EXPERIENCE

1971-1973	Research Associate In Toxicology	Harvard School of Public Health
1972-1975	Analytic Consultant	Children's Hospital, Boston Blood Preservation Laboratory
1972-1979	Consultant and Lecturer on Industrial Toxicology	Boston Poison Control Information Center
1973-1978	Assistant Professor of Toxicology	Harvard School of Public Health
1974-1977	Instructor and Course Co-ordinator, Toxicology and Product Safety Evaluation	Northeastern University
1974-1975	Analytic Consultant	General Tire and Rubber Company, Akron, Ohio
1975-1979	Reviewer, Ad Hoc Grants Review Committee	Division of Advanced Environmental Research and Technology National Science Foundation Washington, D.C.
1975-1979	Consulting Toxicologist Cancer Bioassay Reviewer	Energy Resources Company Cambridge, Mass.
1975-1979	Chairman, Medical Area Subcommittee on Laboratory Safety	Harvard Medical School
1975-1978	Member, Subcommittee on Doctoral Program and Committee on Admissions and Degrees	Harvard School of Public Health
1976	Expert Witness - Toxicology of Kepone	Office of Regional Solicitor, U.S. Department of Labor, Philadelphia, PA
1976-1977	Consultant to the Plaintiff-Toxicology of Kepone	Hundley, Taylor, and Glass. Richmond, VA
1976	Review Consultant. Criteria Document on PCBs	NIOSH

1976	Lecturer of Industrial Toxicology	G.E. Short Course. Harvard School of Public Health
1977-	Consulting Toxicologist. Chemical Health Committee	Polaroid Corporation Cambridge, Mass.
1977	Instructor, Post Graduate Course, Toxicologic Evaluation of Industrial Chemicals by Rapid, in vitro methods.	American Occupational Medical Association
1977	Review Consultant, Criteria Document of Vinyl Monomers	National Institutes of Occupational Safety and Health
1977-1978	Panel Member. Subcommittee on Flammability of Di-electrics	National Academy of Engineering, NAS-NRC
1977-1978	Member. Microbiologic and Oncologic Biohazards Committee	Harvard Medical School and Harvard School of Public Health
1978	Expert Witness, Styrene	U.S. Department of Labor OSHA
1978	Expert Witness and Toxicology Consultant on Dimethyl Amino-propionitrile (NIAX ESN)	U.S. Department of Labor OSHA
1978	Consultant on Toxicology and Industrial Hygiene of Phosphine	Boston Poison Control Center and United States Coast Guard
1978-1979	Associate Professor of Toxicology	Harvard School of Public Health
1979-1983	Associate Professor of Environmental Medicine	New York University Medical School
1978-1979	Lecturer on Toxicology, ATT Medical Director's course on Industrial Hygiene and Toxicology	Bell System Technical Education Center Lisle, Il.
1979	Criteria Reviewer and Committee Member, Water Quality Standards Division	Environmental Protection Agency, Cincinnati, Ohio
1979	Lecturer on Toxicology	General Electric Co. Schenectady, New York
1979-	Visiting Lecturer on Environmental and Industrial Toxicology	Harvard School of Public Health

1979	Consultant on Curriculum and Career Opportunities in Toxicology	Northeastern University Department of Pharmacology School of Pharmacy and Allied Health Professions Boston, Massachusetts
1980 - 1984	Criteria Document Review Vinylidene Chloride Acrylonitrile Trichlorethylene Perchloroethylene	Environmental Protection Agency, Washington, D.C.
1980-1981	Quality Assurance Review Panel, Document Review	Clement Associates Washington, D.C.
1980	Consultant	Occupational Health Services Inc., Cambridge, MA
1980	Consultant	Metropolitan Life Insurance Co., New York, NY
1981	Lecturer	Bell Laboratories, Murray Hill, NJ
1981	Review Consultant, Human Reproductive Toxicity, Council on Environmental Quality	Clement Associates Washington, DC and CEQ
1982	Councilor	Middle Atlantic SOT
1982	Invited Lecture, Proposed Inhalation Toxicity Testing Guidelines	Toxicology Forum, Aspen, CO
1982	Expert and Rapportuer, Criteria Document Task Group, Styrene Health Effects	World Health Organization International Program on Chemical Safety, Helsinki
1983	Councilor, Member of Program Committee	Inhalation Toxicology Specialty Section
1983 - date	Research Professor	Institute of Environmental Medicine, New York University Medical Center, New York, NY
1983	Invited Speaker	Institute of Occupational Health, Helsinki, Finland

1983	Invited Speaker	United Rubber Workers Akron, OH
1983	Consultant	American Cyanamid Co. Wayne, NJ
1983 - 1985	Consultant	AT&T-Bell Laboratories Murray Hill, NJ
1983 - 1984	Associate Scientist	Clement Associates Arlington, VA
1983	Consultant to Defendant and , Expert Witness on Perchloroethylene	Goodwin, Procter and Hoar Boston, MA Inter-state Uniform Co. Woburn, MA
1983	Consultant and Expert Witness Structure Activity Relationships	Life Systems Inc. Cleveland, OH Office of Toxic Substances, USEPA Washington, DC
1983 - 1984	Consultant	Patterson, Bellknap Webb and Tyler New York, NY
1983	Consultant and Expert	Hale and Dorr Boston, MA
1983	Consultant	Mueller's Macaroni Co. Jersey City, NJ
1983 - 1984	Consultant to Plaintiff Expert Witness Metals and Organics	Attorney-General State of New York
1984 - 1986	Consultant and Expert Creosote, Pentachloro- phenol and Dioxins	Southern California Edison Co., Rosemead, CA and Visalia, CA
1984	Consultant	Karch and Associates Washington, DC
1984 - 1985	Consultant To Plaintiff Expert Witness Superfund US v. Hooker Chemical Co.	US EPA and US Dept. of Justice Washington. DC Niagara Falls, NY
1984	Consultant Safety Evaluation Consumer Product	Plymouth Rubber Co. Canton, MA

1984	Invited Speaker Combustion Toxicology of Plastics	Second Annual Fire Engineering Conference Manhattan College, Fire Engineering Institute Riverdale, NY
1984	Consulting Toxicologist Ground Water and Air Toxics Programs - Risk Assessment	Environmental Research and Technology Concord, MA
1984	Consulting Toxicologist Ground Water	Combustion Engineering Windsor, Ct.
1984	Document Reviewer Health Effects of PCBs and Dioxins	Electric Power Res. Inst. Palo Alto, CA
1985	Consultant	Albert Orgain, IV Esq. Richmond, VA
1985	Consulting Toxicologist Consumer Labeling Art Supplies and Inks	Esselte Letraset Moonachie, NJ
1985	Consulting Toxicologist	New York Telephone Co. New York, NY
1985	Consulting Toxicologist	Spengler Environmental Consultants
1985	Lecturer on Industrial Toxicology	Organic Chemistry R&D AT&T Bell Labs, Murray Hill, NJ
1985	Consulting Toxicologist Air Toxics Regulations	Env. Res. Technol and Connecticut Business and Industry Alliance, Hartford, CT
1985	Product Registration, PMN and Process Importation- Toxicology	Gallafent & Co. London, England
1985	Review - Biochemical Toxicology & Effects Ranking	US EPA Environmental Criteria and Assessment Office, Cincinnati, OH
1985	Food Safety Review Smoked Meats	William Casagrande Casa Market Bergenfield, NJ

1985	Review - Health Effects of Municipal Solid Waste Incineration	Penobscot Energy Resource Company, Orrington, Maine Cambridge Analytical, Boston, MA
1985	Health and Safety - Galvanized iron pipes for drinking water	The Wadleigh Law firm Manchester, NH
1986	Wood Preservation Chemicals and Soil Contamination	Gardere and Wynne, Dallas, TX
1986	Toxicology Consultant	Townley and Updike
1986	Plaintiff's Expert	Timothy Ellis, Esq. Brown, Terrell, Hogan and Ellis, Jacksonville, FL
1986	Document preparation for Science Advisory Board on perchloroethylene	Goodwin, Proctor, & Hoar Boston, Mass., Unifirst Corp.
1986	Development of Health and Safety Plan for Waste disposal site	Remediation Technology, Inc. Pittsburgh, Pa.
1986	Toxicology Consultant	Womble, Carlyle, Sandridge & Rice Winston-Salem, NC
1986	Document Service	Jones, Day, Reavis, & Pogue Washington, DC
1986	Consultant: product labeling process importation	Esselte Letraset UK London, England
1986	Toxicology Consultant	Ropes and Gray Boston, MA
1986	Toxicology Consultant	Union Carbide Corp Law Department Danbury, CT
1986	Toxicology Consultant	Goodwin, Procter and Hoar Boston, MA
1986	Toxicology Consultant	Lord & Taylor, NY
1986	Toxicology Consultant	IBM Corporation Armonk, NY
1986	Indoor Air Pollution Health Risk assessment	Ramapo College, Mahwah, NJ

1986	Air Pollution and Hazardous Waste Risk Assessment	So. Calif. Edison Co. Venice, CA
1986	Toxicology Consultant	Greenberg, Dauber and Epstein Newark, NJ
1986	Document Review NJ Water Quality	Hackensack Water Co. Harrington Park, NJ
1987	Toxicology Consultant	Shaheen, Cappiello, Stein & Gordon Concord, NH
1987	Toxicology Consultant Special Advisory Committee Methyl Chloroform	State of Michigan Department of Natural Resources Lansing, MI
1987	Toxicology Consultant	Monsanto Agricultural Company St. Louis, Mo.
1987	Toxicology Consultant	Walton, Lantaff, Schroeder & Carson, Miami, Fla.
1987	Toxicology Consultant	Akin, Gump, Strauss, Hauer & Feld, Washington, DC
1987	Toxicology Consultant	Williams & Connolly Washington, DC
1987	Toxicology Consultant	AMAX Mineral Resources, Inc. Golden, Colorado
1987	Toxicology Consultant	Griffith & Burr Philadelphia, Pennsylvania
1987	Toxicology Consultant Product Registration	Hyperion Catalysis International, Boston, Ma.
1987	Toxicology Consultant	Ryan, Ryan, & Hickey Stamford, CT
1987	Toxicology Consultant Asbestos Hazard Evaluation	Fort Lee Board of Education Fort Lee, New Jersey
1987	Hazard Communication Training Programs	Bell Communications Research Piscataway, New Jersey
1988	Toxicology Consultant Asbestos Hazard Evaluation	Palisades Park Board of Education, Palisades Park, NJ

PUBLICATIONS AND REPORTS

(Cited in Alphabetical Order)

- Bushnell, P. J., and R. J. Jaeger. 1985. Hazards to Health from Airborne Lead. Human and Veterinary Toxicology.
- Cheng, L., and Jaeger R. 1982. Acrylonitrile Solubility in Human Blood: Determination of the Ostwald Partition Coefficient. J. Appl. Toxicol. 2: 18-20.
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- Jaeger, R. J. 1977. Effect of 1,1-dichloroethylene exposure on hepatic mitochondria. Res. Comm. Chem. Pathol. Pharmacol. 18(1): 83-94.
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- Jaeger, R. J., R. B. Conolly, and D. S. Murphy. 1973. Diurnal variation of hepatic glutathione concentration and its correlation with 1,1-dichloroethylene inhalation toxicity in rats. Res. Comm. Chem. Path. Pharmacol. 6(2): 465-471.
- Jaeger, R. J., R. B. Conolly, and D. S. Murphy. 1974. Effect of 18 HR fast and glutathione depletion on 1,1-dichloroethylene-induced hepatotoxicity and lethality in rats. Experimental and Molecular Pathology 20: 187-198.
- Jaeger, R. J., R. B. Conolly, and D. S. Murphy. 1974. Toxicity and Biochemical Changes in Rats after Inhalation exposure to 1,1-Dichloroethylene, Bromobenzene, Styrene, Acrylonitrile or 2-Chlorobutadiene. Toxicol. Appl. Pharmacol. 29: 81.
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- Jaeger, R. J., I. L. Cote, A. E. Rogers, E. H. Silver, and Szabo S. 1984. Acute Toxicity of Acrylonitrile: Effect of Diet on Tissue Nonprotein Sulfhydryl Content and Distribution of 1-14C-Acrylonitrile or Its Metabolites. J. Amer. Coll. Toxicol. 3: 93-102.
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- Jaeger, R. J., and Plugge H. 1980. Acute urinary bladder toxicity of a polyurethane foam catalyst mixture: a possible new target organ for a propionitrile derivative. *J. Environ. Pathol. and Toxicol.* 4-2,3: 555-562.
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- Jaeger R. J., and M. J. Gearhart. 1982. Respiratory and Metabolic Response of Rats and Mice to Formaldehyde Exposure. Middle-Atlantic Society of Toxicology.
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